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TRIP REPORT
2003 AERIAL SKETCHMAP MISSION IN BRAZIL
June 2 - 14, 2003

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INTRODUCTION

During the period June 2 - 14, 2002, we traveled to southern Brazil to aid in technology development and lend technical assistance to counterpart specialists at Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), the Brazilian Agricultural Research Institute. This assistance focused on the remote sensing process of aerial sketchmapping for detection and mapping of damage caused by forest insects, disease and other factors affecting the health of plantations and natural forests. Aerial sketchmapping has been a valuable remote sensing tool for accomplishing these goals within the United States for many decades. This mission is part of an on-going EMBRAPA-USDA Forest Service technical exchange agreement with regard to management of European wood wasp, *Sirex noctilio*, an insect native to Europe. During the past few decades this destructive exotic forest pest has been introduced into several countries in the southern hemisphere, including Brazil. This pest also has the potential for introduction and establishment in the southeastern United States where it could cause significant economic and ecological damage to the pine forests. The tasks performed and the projects implemented during this mission were based on a study conducted in 2001. The 2001 study was initiated to determine the feasibility of aerial sketchmapping as a tool to locate measure and assess forest damage in Brazil (Ciesla and Johnson 2001). Once it was determined that sketchmapping was an effective remote sensing tool, within the scope of these objectives, training of Brazilian counterparts began and related mission work was undertaken in 2002 (Ciesla and Johnson 2002). The current mission was set forth to further assist our Brazilian counterparts as they develop their skills, and knowledge base within the areas of integrated pest management and remote sensing. As work continues within this cooperative project various applications using sketchmapping within the management of the forests in southern Brazil have been discovered. While exploring these possibilities other potential remote sensing tools may be of use within the scope of this developing project.

During this mission, the following activities were undertaken:

1. Aerial sketchmapping missions were carried out over various portions of the State of Paraná (PR) identified as high priority areas by EMBRAPA. The primary purpose of these flights was to assess forest health by capturing the various pest signatures and provide additional training and experience in aerial sketchmapping for four EMBRAPA specialists.
2. These missions were also conducted to assess the accuracy of various Landsat satellite images that were interpreted then plotted and subsequently used as working maps for sketch mapping missions. The interpretation of these satellite images was carried out by Yeda Oliveira, Maria Augusta Doetzer Rosot, (EMBRAPA) and Jim Ellenwood (USDA Forest Service) geographic information systems (GIS) specialists. The objective of their interpretation was to distinguish and delineate forest type with an emphasis on capturing pine plantations spatially on the plotted maps.
3. Sketchmapping missions were also conducted in natural preservation areas with the

objective of determining whether this remote sensing tool might be used to capture spatially various forest successional stages. These flights also assessed the accuracy of Landsat satellite images that had been secured and interpreted by a contractor then purchased by the State Government of Paraná. The objective of this interpretation by the contractor was also to delineate forest successional stages spatially.

4. Discussions were also initiated regarding the introduction of *Tsuga canadensis* and *Tsuga caroliniana* in South America as part of an effort to preserve in perpetuity genetic material. Populations of *Tsuga canadensis* and *Tsuga caroliniana* are currently being decimated in the eastern United States by the exotic insect pest hemlock wooly adelgid.

This report summarizes this mission through timetable format. Methodologies used for the operational flights are similar to those described by Ciesla and Johnson 2002.

TIMETABLE

June 2	Rhea and Johnson arrived in Curitiba, Brazil.
June 3	<p>Rhea and Johnson spent the day at the EMBRAPA compound in Colombo, Paraná touring their outstanding biological control facility and reviewing plans for the week. Equipment purchased by the USDA Forest Service, including an aviation intercom system, GPS unit, software, and headsets, were delivered to EMBRAPA personnel. Several hours were spent training EMBRAPA personnel in the use of this equipment. This GPS equipment will allow the survey specialists within EMBRAPA to track their current position and create flight routes with ease and help ensure the accuracy and quality of map products produced.</p> <p>Later, a meeting was held with Erich Schaitza regarding a new State program aimed at delineating and monitoring native forest conservation corridors and riparian buffer zones. This program is the result of new regulations and laws being developed and implemented aimed at curtailing the conversion of native forest land, within the late successional stages, to non-native tree species for commercial purposes or agriculture. These laws also require that specific riparian buffer zones be maintained in an effort to maintain and improve water quality.</p>
June 4	The first portion of the day was once more spent at the EMBRAPA compound continuing mission planning efforts and preparing maps. In the afternoon, Rhea, Johnson, Celso Auer and Yeda Olivera traveled 4 hours by car to Telêmaco Borba, PR in preparation for an aerial survey over pine plantations owned by Klabin Industrial.
June 5	Due to heavy rains, Joel Penteadó and Juliano Woiski Heckler (pilot) could not ferry from Curitiba to Telêmaco Borba in the morning as planned. As an alternative, we met with Cordeiro Luis (Forest Health Specialist for Klabin Industrial) and toured key areas on their plantation including: <i>Sirex</i> trap tree situations, <i>Sirex</i> damage, monkey damage, and a

world-class arboretum. We were also able to view assorted pest signatures from a distance to better calibrate our eyes to the various damage agents. That afternoon, we met with Ivone Fier (Head Forestry Research Coordinator for Klabin Industrial) to discuss the possibility of *Tsuga* introduction within southern Brazil. Also present was their biologist working to control the monkey problem. Finally, we visited the company's apothecary, pharmacy and herbal production facility. Klabin has a novel approach to health care for the employees that might serve as a model to many other large companies around the world (for more information on Klabin Industrial, visit their website at <http://www.klabin.com.br/>).

- June 6 Again, because of continued rain, an aerial survey was not feasible. Instead, Rhea, Johnson, Auer and Olivera traveled back to Curitiba by way of Castrol and Abapá. En route, we visited Floresta Nacional do Açungui and a pine plantation owned by Ambiental. There, we visited 2 year-old and 5 year-old *Pinus* plantations with significant *Armillaria* root disease problems. Because this plantation was scheduled to be surveyed by us, it provided an opportunity to evaluate the potential for aerial detection of various infection levels. In addition, *Armillaria* management strategies were discussed with Celso Auer and the company's forester where we suggested that greater tree spacing aimed at promoting tree vigor may better withstand the disease. It was not uncommon to see tree spacing of 2 meters by 2.5 meters. It was also recommended that more fallow time be allowed between harvest and planting. In many instances harvest occurs and reforestation efforts begin immediately, possibly increasing the opportunity for insects and pathogens to remain in place, thus impacting the subsequent plantation.
- June 7/8 Spent the weekend in Curitiba witnessing impressive rainstorms and went to the Festa do Pinhão, where locals celebrate the harvest of *Araucaria* nuts by feasting on the seeds and drinking Quentão.
- June 9 Johnson, Rhea, Penteadó, Heckler, and Ivan G. da Silva drove from Curitiba to Ponta Grossa (where the aircraft was now located). With Johnson, Rhea, Penteadó, and Heckler present in the aircraft, we ferried 40 minutes to an area SW of Telêmaco Borba (owned by Klabin Industrial) where an aerial survey was initiated. We mapped discoloration in pine and sirex damage. We used the plotted Landsat classification developed by Oliveira, Maria Augusta Doetzer Rosot, and Jim Ellenwood as our base map; we were also able to record commission and omission errors of the pine classification. The quality of the plotted base maps and the interpretation by Oliveira, Maria Augusta Doetzer Rosot, and Jim Ellenwood yielded a superior result during this mission. Returned to Curitiba PM.
- June 10 After driving to Ponta Grossa from Curitiba, Johnson, Rhea, Penteadó, and Heckler initiated an aerial survey ENE of Ponta Grossa (near the town of Abapá). There, we were

able to map Sirex mortality, Armillaria mortality, pine discoloration, and classification errors of omission and commission. Again the quality of the maps as well as interpretation was excellent which made the task of capturing the various pest signatures spatially much easier.

- June 11 We drove from Curitiba to Ponta Grossa. Once there we ferried south one hour to Guarapuava. There we waited for EMATER (Parana State Government Extension Service), SPVS (Wilderness Protection) and IAP (Environmental Department of Parana State) personnel to arrive. These agencies, in partnership with EMBRAPA, are charged with delineating and monitoring the health of native forests as well as maintaining conservation corridors. Several flights were initiated that day to provide them with aerial views of the various successional forest classes, which is the primary basis for determining land use zones or potential. Rhea, Johnson, and Ricardo Brites (SPVS) surveyed an area 75 KM SSW of Guarapuava known as Rio Dos Touros to assess successional stages of native forest. Ricardo Brites, an ecologist, instructed Rhea and Johnson on the various visual signatures which indicate major successional stages. The aerial sketchmapping results were compared to the Landsat classification made by contractors for the State government of Paraná. Following the survey, members from EMBRAPA agreed that the sketchmap provided a more accurate and realistic map product than did the contractor's classification. Overnight in Guarapuava.
- June 12 In the morning, another overview flight of Rio Dos Touros was provided for personnel from the various agencies over several native forest in order to observe the various succession stages. While these observations were made Joel Penteado sketchmapped riparian buffer zones in an effort to determine the feasibility of using this tool for documentation and delineation (State laws mandate a minimum of 30 meter buffer zone for stream protection). Later, Johnson, Rhea, Olivera and Leandro (pilot) sketchmapped native forest successional classes of the Mangueirinha protected area 100 KM SW of Guarapuava. The aerial views of these old-growth forests with large inclusions of pure Araucaria stands were sublime. Once again, we agreed that the sketchmap was superior to the contractor's Landsat image classification.
Returned to Curitiba PM. Upon arrival in Curitiba Rhea and Johnson outlined this trip report.
- June 13 We spent our last full day in Brazil transferring polygons from the aerial survey maps onto mylar for digitizing. At 4:00PM, Rhea and Johnson met with Erich Schaitza, Yeda Olivera, Celso Garcia Auer, Moacir Sales Medrano, Edson Tadaeu Iede, Joel F. Penteado Jr. and Marlise Zonta for the close-out meeting, which is described below in the next section.
- June 14 Rhea and Johnson depart Curitiba for the United States.

CLOSE OUT MEETING WITH EMBRAPA

A closeout meeting was held with key EMBRAPA personnel on Friday June 13, 2003. The meeting was chaired by Erich Schaitza, Deputy Chief, Communications and Business. After opening remarks an overview of the previous 2 weeks was provided by Rhea and Johnson. The group was pleased to see that the cooperative project was providing an excellent mechanism for exchanging information and knowledge to our Brazilian counterparts. The use of remote sensing within the scope of this project has proven to be an efficient and effective tool for resource managers. It has allowed those managers who are dealing with pest issues to make more informed and effective decisions. The group agreed that as more pest issues become relevant (*Armillaria*, monkey damage) to managers this tool will only prove more valuable. It was obvious to the group that great progress has been made within the scope of this project. The knowledge base and skill level continues to increase on all levels of this project while simultaneously new applications for these tools are being realized.

One of these new applications was the use of the sketchmapping as a mechanism to capture spatial information on location and successional stage of native forests and preserves and to delineate riparian buffers. While not the best tool for this type of mission it was much more accurate and cost effective than the interpreted Landsat images we had at our disposal. With this in mind it was suggested that an excellent and cost effective method for collecting such information could be accomplished using digital video. The process of capturing and processing such digital information was explained to the group. Various applications that the USDA Forest Service, Forest Health Protection has developed for such digital images were also described. This information could be captured for about the same cost as sketchmapping missions and allow for detailed interpretation with highly accurate results. After some discussion by the group on the costs, and products that might be produced it was agreed that there is interest in implementing this remote sensing tool. The group was very interested in pursuing the possibility of a pilot program to evaluate the potentials of digital video within natural resource management in Brazil. The group tentatively decided that they would like to hold a seminar in October 2003 on the topics of both sketchmapping and digital video for a larger portion of their staffs and also include resource managers from forest industry. They feel that these tools could increase the efficiency and effectiveness of management of commercial forest lands, native forests and ecological preserves. The group then made an invitation to Rhea and Johnson to provide such a seminar. The group decided that they would formally invite Rhea and Johnson back to Brazil in October 2003 for the purpose of providing a seminar on these various remote sensing tools and to continue training the Brazilian counterparts within the existing project.

All parties involved in this project, both USDA Forest Service and EMBRAPA, were pleased with its outcome, the excellent level of fellowship and accomplishment.

REFERENCES CITED

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KEY PEOPLE CONTACTED

EMBRAPA

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